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The Editor's Page

AS authorized by the Board of Directors of U. S. Institute for Textile Research, Inc., on Nov. 12th, Acting-President E. H. Killheffer drew up and presented, with a covering letter, to the Directors of the Textile Foundation, for consideration at their meeting Dec. 8th, a detailed plan and proposal for a "Textile Research Institute." Receipt was duly acknowledged with the statement that this and a number of proposals from other organizations have been referred to a Special Committee of the Board for careful consideration.

* * *

UNINTERRUPTED continuance of U. S. Institute's research on warp sizing and sizing materials, which has been in progress at Massachusetts Institute of Technology since May, 1935, is assured by renewal of a grant of $2,500 by the Textile Foundation, and renewals of a large proportion of the Contributing memberships ear-marked for this project. A meeting of U. S. Institute's Research Council was held Dec. 10 by courtesy of Wright Bolton, chairman of the Administration Committee for this study, at his office in the Rayon Division of Pacific Mills, Lawrence, Mass., where experimental sizing under scientific mill conditions is nearing completion. As a result of this visit Council members are more enthusiastic than ever regarding the status and prospects of the study, and unanimously approved the following report of the Administration Committee:

"Last year at a meeting of co-operators in New York, we reported to you that the warp sizing research up to that time had consisted primarily of laboratory work designed (1) to develop the necessary technique required for evaluations, and (2) the assembling of apparatus and equipment, and the elimination of variables in sizing processes in order to reduce the research to practical mill sizing on a plant scale.

"During 1937 the laboratory technique has been completed, and the practical warp sizing in a representative mill has been started, and is under way at the present time.

"Some results, which have a profound bearing upon the sizing, and ultimately upon weaving efficiency, have already been found. It is expected that the warp sizing research, as a result of the work expected to be done early in 1938, will develop important, worthwhile information, which can be presented to the co-operators in a form allowing easy and practical application to warp sizing processes of natural and synthetic fibres.

"In summarizing we can say that during 1938 we hope to capitalize upon the very large amount of difficult and tedious laboratory research, which has been necessary in order to reduce the warp sizing problem to practical warp sizing considerations, and to secure accurate evaluations of the variables tested."

* * *

YOUR Board of Editors is gratified to be able to present to the readers of Textile Research the series of unusually informative papers on textile testing that was the feature of the meeting of the textile committee (D–13)

(*Continued to P. 92.*)

A. A. T. C. C. Annual Meeting

ONE of the most successful annual meetings of the American Association of Textile Chemists and Colorists, both in attendance and quality of program, was held at the Bellevue-Stratford Hotel, Philadelphia, December 3 and 4, under the auspices of the Philadelphia Section. The convention was formally opened Friday evening, following a "platter supper" in the hotel ball room; at this session Henry E. Millson of the Calco Chemical Co. read an interesting paper on "Queer Forms of Light," and this was followed by a motion picture in natural colors entitled "Growing Crystals," presented by Lloyd A. Jones of the Eastman Kodak Co. The remainder of the evening was devoted to a vaudeville program and social intercourse.

Prior to the formal opening of the convention a luncheon was tendered by the Philadelphia Section to the national officers, Council and members of the Research Committee, and during the afternoon there were the usual annual meetings of the two latter bodies. Reports of these, and also of the papers presented at the Saturday, Dec. 4, sessions and at the banquet Saturday evening will be published in due course in the American Dyestuff Reporter, the official organ of the A. A. T. C. C. Abstracts of the technical papers appeared in the Nov. 29 issue of the latter publication (Pp. 759–61, 764–65); titles and authors are as follows:

The Technical Papers

"Extraneous Matter in Textile Materials: An Investigation of the Nature of the Material Obtained by the Extraction of Wool with Ethyl Alcohol." Bertil A. Ryberg, A. A. T. C. C. Research Associate at Lowell Textile Institute.

"Practical Consideration of Modern Wool Dyeing Methods." E. W. Pierce, Ciba Company.

"What Can the Mill Man Expect from Fundamental Research?" Milton Harris, A. A. T. C. C. Research Associate at the National Bureau of Standards.

"The Quantitative Measurement of Stiffness and Resiliency." Irving J. Saxl, Consulting physicist and chemist, Providence, R. I.

"Evaluation of Crease Resistant Finishes for Fabrics." Herbert F. Schiefer of the National Bureau of Standards.

"Metallized Azo Dyes." M. L. Crossley, Calco Chemical Company.

"Trends in Textile Technology." E. R. Schwarz, Professor of Textile Engineering, Massachusetts Institute of Technology.

"Detergents and Their Application to Textile Processes." J. B. Crowe, The Procter and Gamble Company.

"Color Measurement in the Dyestuffs Industry with Special Reference to Fastness Tests." Isaac H. Godlove, E. I. du Pont de Nemours & Company.

"Suggestive Observations on the Wetting, Mercerization and Dyeing of Cellulose." Charles F. Goldthwait and Earle R. McLean, Industrial Fellows, Mellon Institute of Industrial Research.

"A New System of Organic Synthesis and Its Application to Textile Assistants." A. Frank Bowles, E. F. Houghton & Company.

"The Use of Standard Dyeings in Tests for Color Fastness to Light." William D. Appel, Chief, Textile Section, National Bureau of Standards, and Chairman, A. A. T. C. C. Committee on Light Fastness.

The Banquet Program

The annual banquet Saturday evening, with an attendance estimated at 1200 members and guests, brought the convention to a fitting close. Dr. E. H. Killheffer, Former President of the A. A. T. C. C. and Acting President of U. S. Institute for Textile Research, acted as toastmaster. The list of speakers was as follows: Mayor S. Davis Wilson of Philadelphia; William H. Cady, retiring President of the A. A. T. C. C.; Alban Eavenson, who succeeds Mr. Cady as President of the A. A. T. C. C., and is a Vice President of U. S. Institute for Textile Research; Prof. Louis A. Olney. President Emeritus of the A. A. T. C. C. and Chairman of its Research Committee, also a director of U. S. Institute; Prof. Ivor Griffith of Wagner Institute of Science; Hon. Franklin S. Edmonds, prominent Philadelphia attorney and civic leader, whose subject was "Opportunity or Security."

New Officers Elected

New officers and councilors-at-large elected by the Association are as follows:

President, Alban Eavenson, Chairman of the Board, Eavenson & Levering Co., Camden, N. J.

Vice-President, Duncan Ferguson, General Manager, Shelton Looms, Shelton, Conn.

Vice-President, Arthur R. Thompson, Jr., Ciba Co., Inc., Charlotte, N. C.

Treasurer, William R. Moorhouse, Resident Manager, National Aniline & Chemical Co., Boston, Mass.

Councilor-at-large, Walter M. Scott, Gustavus J. Esselen, Inc., Boston, Mass.

Councilor-at-large, Harold DeWitt Smith, Treasurer, A. M. Tenney Associates, Inc., New York, N. Y.

(*Continued from P. 90.*)

of the American Society for Testing Materials in New York City, Oct. 21. The first of these papers, "Tests for Mechanical Properties of Yarns," by H. F. Schiefer, was published last month. It is followed in this issue by the paper of Charles J. Huber on "Tests for Physical Properties of Fibres," with discussions relating specifically to cotton fibres by Dr. Robert W. Webb and Malcolm E. Campbell. A third paper by Prof. Herbert J. Hall, chairman of Committee D–13, on "Abrasion and Wear Testing Machines for Textiles" is awaiting publication, but it is understood that this is also to appear in the Bulletin of the A. S. T. M. for December. Of particular value to those engaged or interested in wear testing is its accurate description of the mechanism, operation and other details of eleven representative wear testing machines.

Tests for Physical Properties of Fibres

By CHARLES J. HUBER * †

General

THE tests for the physical properties of fibres from a practical point of view may be divided into two general classes:

1. Tests for the determination of factual data used with quantity measurements of fibres.
2. Tests controlling the quality characteristics of fibres.

Into the first class may be grouped the moisture absorption and desorption measurements, the establishment of accepted standards of regain and the setting up of definite procedures for routine tests on which commercial transactions may be based. Extraction tests for wool, degumming tests for silk and scouring tests for rayon also fall into this category.

The second class comprises a very broad field of testing designed especially to select fibrous material having the particular properties required to produce a finished product to meet the trade demands. This may include high-gum-content raw silk to produce "mirror" satin; abaca to be used for trap rock rope; spun asbestos for heat insulation or glass fibre for filter cloths. While this field is broad, to cover the subject in the time allotted this paper must necessarily be limited to the more general tests now in use and as they are applied in grading quality of the more common textile fibres with special emphasis on silk and rayon.

Sampling

In all types of testing, it is most important that the sample tested is selected at random and is representative of the lot tested. While a great deal of work has been done in this country on cotton and wool, the outstanding work in silk was done by Mr. Higo [1] in Japan, in which he thoroughly investigated the probable error in sampling a lot of raw silk both from a mathematical and practical standpoint. The method used in the trade today agrees largely with his findings.

Quantity Tests

Equilibrium Moisture Content: A large amount of research has been carried out in many countries on the equilibrium moisture content on silk,[2] cotton,[3, 4] wool and rayon fibres.

In materials such as textiles which possess a high degree of capillarity and absorptivity, the equilibrium moisture content for a given at-

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† This paper was read at the Papers Session of Committee D-13, A. S. T. M., held in New York City on October 21, 1937.

mospheric condition of temperature and relative humidity depends upon the direction from which the equilibrium is approached. If the textile is gaining moisture in coming to equilibrium with the humidity of the surrounding atmosphere then the data for equilibrium moisture content are to be found under column heading "A," Table 1, denoting absorption. If the textile is losing moisture in coming to equilibrium with the surrounding atmosphere then the equilibrium values to be used are those found under column heading "D," Table 1, denoting desorption. The significant facts brought out are:

1. For all textile material listed, the equilibrium moisture content increases rapidly between relative humidities of 60% and 75%.
2. The moisture content by absorption is always lower than for desorption.
3. At 65% relative humidity (our standard humidity) the difference between absorption and desorption is about 2% for raw silk and cotton, and nearly 1.5% for the other fibres.
4. The order of the textile materials listed according to decreasing equilibrium moisture content is, wool, viscose, rayon, cuprammonium rayon, raw silk, degummed silk, cotton, and acetate rayon; for example, at 65% relative humidity the values are:

TABLE 1

	Wool	Viscose	Cupram-monium	Silk		Cotton	Acetate
				Raw	Degummed		
"A" Absorption....	14.5	14.1	13.4	10.9	8.9	6.8	6.0
"D" Desorption....	16.0	15.6	14.9	13.2	10.1	8.5	7.7

In commercial work it is found impracticable to use extensively the equilibrium moisture content method. The history of the material sampled is usually not known, besides the time element involved in allowing the sample to reach equilibrium is too great. For this reason standard regains have been adopted by the trade.

TABLE 2. STANDARD TEXTILE REGAIN

Material	Recommended by	Percent Regain
Raw Cotton	U. S. Testing Co.	8½
Cotton Yarn	A.S.T.M. D180–36	7
Mercerized Cotton	Div. of Simplified Practice	8½
Cotton Cloth (Dyed or Undyed)	U. S. Testing Co.	6½
Scoured Wool	A.S.T.M. D232–36	13.6
Woolen Yarn	A.S.T.M. D403–36	13.0
Worsted Yarn, Oil Spun (Bradford)	A.S.T.M. D404–36	13
Worsted Yarn, dry spun (French)	A.S.T.M. D404–36	15
Silk (Raw)	International Standard	11
Rayon, Nitrocellulose, Viscose	A.S.T.M. D258–35T	11
Rayon, Cellulose-Acetate	A.S.T.M. D258–35T	6½

Yarns containing a mixture of wool, cotton, rayon, or silk fibres either by mix, blend, or ply, have their standard moisture regain computed from the percent of fibre content by weight (dry basis) and the normal moisture regain for that fibre.

The ventilated drying oven is operated for raw silk at 135–140° C., and requires about 20 min. for the sample to reach a constant weight as determined by two consecutive weighings without removal from the oven, taken 5 minutes apart and showing a further loss of not more than 0.1% from previous weighings.

For rayon, wool and cotton the same procedure is used for determining "oven-dry" weight, excepting that the temperature is reduced to 105–110° C. and the time interval between the two consecutive weighings is increased to 10 minutes.

Oil and Gum Content

While most textile fibres are purchased by the pound, they are eventually sold by the yard and for this reason the purchaser must know accurately any foreign material or natural oils or gums which are removed in the mill processes.

The method of testing for hard scoured wool in wool in the grease, in which the free fat, soap fat and ash are determined separately, is given in detail in A.S.T.M. Designation: D–232–36.

The gum content of raw silk is obtained in the familiarily known "Boil-off" test. In this the "oven-dry" raw silk sample is degummed in a 1% solution of soap having a low titer, at 100° C. and thoroughly rinsed in soft water. The sample is returned to the ventilated drying oven to obtain the "oven-dry" clean fibre weight. The difference between the oven-dry weights of the raw silk and the clean fibre is the amount of gum removed.

For the determination of oils and sizings, or viscose rayon, the same test is used as for raw silk with the exception of the drying temperature being kept at 105–110° C.

Acetate rayon is scoured with ¼% soap solution at 70–75° C. for removal of oils and sizing materials to give the clean fibre.

Quality Tests

In many types of material tensile strength is taken as indicative of quality and the stress-strain diagram of the testing machine is taken as almost the complete picture as to value for industrial use. In the textile field while tensile strength is used for comparative values and for locating defective fibres, it is not the most important quality or the one which controls the grades. This is probably due to the many features in fabrics where strength is only secondary and where style, draping, handle, novelty of design are the controlling elements. It has become increasingly important to study minutely the fibre structure, the shape and size of its cross-section, the length of the fibres and their scale and crinkle longitudinal appearance as examined under polarized light, even to their ultimate structure as revealed by the X-ray.

To follow more logically the quality tests, we will consider the main textile fibres individually and the tests that are applied to determine their most important characteristics.

Silk

A brief description of raw silk as it is produced in the Orient will help to visualize the testing problems involved. The silk as reeled from Japanese cocoons,[5] has a continuous usable filament length from 600 to 900 meters which varies in diameter from 30 microns in the outer portion to 20 microns on the inside of cocoon. To produce the standard 14 denier raw silk thread most generally used in the United States, five cocoons must be unwound simultaneously and well agglutinated by drawing them through a croissure. With this wide variation of filament diameter from end to end it is necessary to combine new cocoons with one partially unwound so that the resultant raw silk thread will have maximum uniformity of diameter known in the trade as "evenness." When one cocoon is spent, a new filament is added to the remaining four by "easting on" (tacking with its natural gum) without stopping. A skein of silk is produced containing 40,000 meters of thread without a knot.

To unwind the cocoon, it must have the gum (sericin) softened by boiling for 6 to 8 minutes in water. By careful boiling, the cocoon may be filled with water to give it sufficient weight to straighten out the figure-eighths in which the filaments are laid on the cocoon. However with utmost precaution the filaments can not be laid parallel throughout; the loops and filament ends project at right angles to the axis of the thread. These defects are small in size but large in number and are classified in the raw silk trade as neatness defects. When sufficient care is not taken, larger defects as slugs, waste and bad casts appear and are called "cleanness defects."

China cocoons,[6] are usually smaller, containing 400–500 meters of filament varying from 18 to 12 microns in diameter from outside to inside of cocoon. It may be seen that from both length and diameter of filament many more cocoons are required to produce a given quantity of raw silk thread from China cocoons than from those produced in Japan. This is conducive to the production of more even silk but it is difficult to keep down the number of cleanness and neatness defects.

It is also very important that the producing countries do not mix their cocoons in reeling. Tests show that the boiled-off silk fibre (one-half of cocoon filament) varies greatly in size and shape for different species of worms, and for worms raised in different geographic centers. Yarns of the same denier size will give two-tone dyeing when made from filaments having as little as .03 difference in diameter ratio[7] (Ratio of minor to major diameter of fibre cross-section). Also, if the ratio is the same, but where there is 0.7 microns difference between the diameters of the filaments for the two yarns, there will be a noticeable difference in dyeing. The yarn having the larger or the flatter filament will always appear the darker.

Raw Silk Testing

The three primary qualities controlling the grading of raw silk are evenness, cleanness and neatness.

In Europe for the past century or more, evenness has been measured by the deviation in weight of small sample skeins (usually 450 meters in length) from the normal. As more emphasis was placed on thread uniformity, the Japanese introduced the use of 225 meter skeins in about

1920. The shorter length was accompanied by proportionally greater number of skeins. The fractional sizing skein method was developed rapidly from 1925 to 1930.[8] Stehli used 112½ meter skeins; 56¼ meter skeins were used by McCallum; 18 meter skeins by Julius Kayser; 10 and 25 meter skeins by Cheney Bros., and finally the 9 meter skein as developed by Mr. Seem of Julius Kayser.[9]

Fractional or small skein testing has the following advantages and disadvantages:

Advantages:

(*a*) As the weight varies as the square of the diameter, it is a sensitive indicator of the diameter and diameter variations.

(*b*) Practically free from the human element in reeling lengths and weighing.

(*c*) 9-meter method is very critical.

Disadvantages:

(*a*) Larger length (450 m & 225 m) gives too much of an average value to be of much assistance in evaluating silk for hosiery trade.

(*b*) 9-meter method takes a relatively long time and is very laborious.

The seriplane,[10] was developed about 1920 in the Cheney laboratories originally for cleanness inspection, but soon became very popular for evenness estimation. By accurately spacing the thread on the blackboard, and by making this spacing always the same length of thread for a panel, the seriplane gave a rational basis to the well known and much used "mirror" card. With photographic standards as reference and with readings made in carefully designed booths with excellent illumination, reasonable agreement between inspectors is possible.[11, 12, 13]

Advantages:

(*a*) Its appeal to the sense of vision.

(*b*) Test is made easily and rapidly.

Disadvantages:

(*a*) Depends on the judgment of the inspector.

(*b*) Cannot see gradual shading in panel from side to side.

(*c*) A panel, even within itself, is not penalized although its diameter may vary greatly from the normal.

While the seriplane is today used as the test for establishing grades it is often supplemented by other evenness tests, especially the 9-meter and size deviation for silk used in hosiery.

Inasmuch as evenness is a major textile problem applying to yarns made from fibres other than silk as well as silk, a brief summary will be given of some of the developments in recent years.

The problem of determining the evenness is fundamentally a problem of measuring yarn diameters.

The numerical values of diameter measurements may be used to obtain the evenness, either from a plot of the distribution curve or from a mathematical equation expressing the grade of evenness in terms of deviation units.

Unfortunately, there are few practical means of making accurate measurements of thread diameters. Any mechanical apparatus,[14, 15] is certain to distort the thread and will actually record merely some physical characteristic, such as elongation or resistance to compression, which while varying with the diameter also varies with many other thread qualities which are irrelevant to evenness. Measuring the weight per unit length is unreliable with raw silk as the thread is subject to considerable diameter variation due to its degree of compactness as a result of tension, twist and croissure in reeling.

This exhausts nearly all methods except the use of light, which can be employed in three general applications: First, the seriplane utilizes the reflection of light but its limitations and dependence on the human element leave much to be desired. Second, the microscope, by projecting the enlarged image of a thread sample, permits very accurate diameter measurements, but as a method of testing evenness it is limited because of the small size of the sample and the time element involved. The third means of using light is the photometer, which evaluates either the reflection or transmission value of light as affected by different samples. The photometer, as customarily used in laboratories, would require the same skillful and detailed operation as would a microscope. However, by building the photometer around properly designed photoelectric cells and suitable amplifier circuits, it is possible to make accurate and repeatable recordings with a speed which is hampered only by the torque of the electrical recording instruments.

The Huber,[16, 17] Evenometer, an instrument of this type, is an electronic photometer which records thread diameter by measuring the transmission of parallel light between threads uniformly spaced on a slotted board. As the diameters increase, the space between threads decreases, thus reducing the transmission.

The Evenometer is designed to measure accurately the diameter of the thread. As it scans the thread through the slotted seriplane board, it is arranged to determine the deviation of the diameter from the mean, arbitrarily penalize the deviation on a square law basis and automatically record the total penalty for each panel of the board. The time required for the Evenometer test is somewhat longer than the seriplane, but it is not as long or laborious as the 9-meter test and more accurate than either.

Cleanness and Neatness: The cleanness defects are counted on 40 seriplane panels and classified into major and minor defects. The major defects are penalized 0.5 each, while the penalty for the minor defects is 0.1. The total penalty is subtracted from 100 to give the percentage cleanness rating.

The very small defects are compared with standard panels for neatness and are rated accordingly.

Since the advent of the three-carrier method of manufacturing hosiery having a clearer base fabric, raw silk defects have become more important because they can be more easily seen. Recently there has been developed a machine with three sets of cleaners,[18] having openings of .0025″, .0030″ and .0040″ respectively. These cleaners catch the defects and allow an accurate record to be made of the diameter size as well as length. While the preliminary tests on this machine have not been completed, it is believed that it will give much more accurate determinations of cleanness defects.

Exfoliation or "Lousiness": Certain silk filaments tend to break up into fibrils in normal manufacturing processes, especially when subjected to alkaline baths. A tangled mass of fibrils is known in the trade as a silk "louse" and such silk is termed "lousy silk." It is very detrimental in the production of high quality goods, especially in satins, hat bands and sewing threads. The United States Testing Company, Inc., has developed a test by means of a carefully controlled degumming operation which enables an inspector to grade the silk as to its tendency to exfoliate.[19]

Rayon

While it is believed that more careful tests are applied in the production and use of synthetic yarns and fabrics than to any other textile material, practically all of them fall outside of the scope of this paper, which deals with tests for physical properties of fibres. Most tests on rayon fall into one of the three following general classes:

(*a*) Chemical
(*b*) Physical properties of yarns and fabrics
(*c*) Microscopical

Inasmuch as the last two classes are covered in separate papers at this session, they will be omitted here. Due to the great growth of the rayon staple fibre industry during the last year or two and its blending with wool and other natural fibres, it is becoming increasingly important to develop physical tests for rayon fibres. Very recently Saxl,[20] has brought out a filament tester for determining the dynamic characteristics of individual filaments from a stress-strain curve. There has been insufficient time to determine its value in this field. However, some such test must be available to distinguish between the dynamic properties of the various synthetic staple fibres made from wood pulp, cotton linters, casein, or protein from soy beans. Moreover, tests are needed to determine on staple fibres such properties as swelling, interlocking action due to the crinkle formation to simulate felting in wool, and heat conductivity. It is only by such tests that rayon staple fibre can be used to best advantage in its ever increasing field.

Cotton

Methods of test for properties of cotton fibres have been carefully detailed in A. S. T. M. designation D–414–35T and will only be briefly discussed here. These methods cover four major properties:

(*a*) Length and length distribution.
(*b*) Fineness, determined by length and weight.
(*c*) Immaturity count.
(*d*) Strength of fibres in wrapped bundles.

Emphasis is stressed throughout on the care required for proper sampling for preparation of the specimen and for the constancy of the conditions of test.

The degree of mercerization is obtained by measuring the amount of swelling of the cotton fibre as shown in cross-section mounts.

Wool

Sorting machines have been developed and are used by mills in determining the length and length distribution of their wool fleeces and tops for production control.

Tentative methods of test for fineness of wool are given in A. S. T. M. designation D419–35T where the width of the projected image of the fibre is measured and the width distribution determined, giving accurate method for grading wool.

A great amount of work has been done on the wool and hair fibre to determine the effect of time, temperature and humidity on the stress-strain charts and their relation to felting, crabbing and shrinkage. Even Milady is much interested in this, for it tells her why a finger wave is only a temporary set destroyed by subsequent wetting, while a permanent wave, set with temperature, is lost only by the growth of hair. The fundamentals of fibre structure and the use of X-ray for studying its physical-chemical aspects are clearly given by Astbury[21] in his fascinating book on this subject. Perhaps it is not too rash to venture that in the near future the X-ray method of fibre testing will be as common as the microscopic method is today.[22]

Abaca' Fibre

The Becker test developed under the research fellowship of the Cordage Institute at the Bureau of Standards is used today to determine the quality of the abaca' fibre used in manila rope. In this test the fibres in the cross-section of the rope are cut into short lengths (1.5 to 2.5 millimeters long), extracted and dried. The prepared sample of cut fibres is placed in a special cell and its reflectance is measured at 500 millimicron wave length of light with a Marten Photometer. This gives a good index on the quality of the fibre used in rope in terms of the Philippine Island Government rating which is based on color.[23]

Conclusion

In the last decade great progress has been made, not only in developing and standardizing tests, but also in setting up reference standards for guidance in the textile field. In this, Committee D–13 of the A. S. T. M. has taken a prominent lead. Much work on testing methods still remains to be done and will continue as research advances. But the greater handicap in the textile field today is the lack of reference standards for the evaluation of test data.

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Discussion by Dr. Robert W. Webb *

WE are all agreed, I am sure, that Dr. Huber has given us a very interesting discussion on the status of certain tests and data with respect to the physical properties of fibres. The detailed consideration which he has given to silk suggests a number of points for us to think about in connection with the fibre problems and tests of other textile commodities.

The Chairman, Mr. Appel, has asked me to assist with the discussion of Dr. Huber's paper and I appreciate this opportunity. Mr. Appel has asked me, in particular, to place special emphasis on the testing of cotton fibres and to supplement Dr. Huber's paper in that field. This, I shall attempt to do, in so far as the few minutes at my disposal will permit.

Dr. Huber has spoken of two different types of physical testing of textile fibres, from the practical point of view. In the case of cotton, we have encountered a somewhat similar problem, in that, on the one hand, we must find practical and adequate methods for measuring various physical properties; and, on the other, we must find how and to what extent these properties affect the properties of yarns and fabrics. As long as we cannot completely and adequately predict the properties of yarns and fabrics from the properties of the fibres, we must assume either that one or more of our fibre methods are not sufficiently precise, or that one or more of the properties not measured affect the quality of the yarn or fabric manufactured, or both.

The problem is further complicated by reason of the numerous, varied, and specialized uses to which the products manufactured from raw cotton are put; for example, we note such diversity as automobile tire fabrics,

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balloon covering, airplane wing fabric, dress goods, toweling, canvas for holding water and other liquids, sail cloth, etc. The properties which are important for one purpose may be unimportant for another. To illustrate, strength or resistance to repeated stress strains may be very important for tire cords but relatively unimportant for dress goods, where gloss and finishing qualities are more important. Thus, it is obvious that variation in the importance of the properties of manufactured goods causes variation in the importance of the different raw fibre properties.

In this connection, I also should like to point out that the relative importance of a cotton fibre property may vary depending upon the construction of the yarn. For example, from some limited preliminary studies our results have shown that, for 22's yarn, the strength of the raw cotton employed accounted for approximately 50 per cent of the variability in yarn strength; whereas, when the same cottons were spun into 60's yarn, the raw cotton strength accounted for only about 25 per cent of the variation in yarn strength. This gives us a good deal to think about with respect, not only to cotton, but to other textile fibres.

We have had a considerable number of inquiries concerning methods for measuring cotton "spinning value." The expectation of finding a single, "over-all" measure for cotton spinning value, outside of the spinning test itself, does not appear very hopeful. The fibre tests that have been developed thus far are for some one fibre property; as, for instance, length, strength, maturity, fineness, etc. While considerable association may exist between some of the fibre properties, as for example between length and fineness of fibre, still in other cases little or no association seems to exist.

We in our laboratories are studying the fine crystalline structure of the cotton fibre, as shown by X-ray analysis, and it has been presumed by some that we hope to predict the "over-all" spinning value by this means. Of course, we do not expect any such good fortune. What we do hope to do is to find a rather simple and more practicable measure for determining one of the properties that influence spinning value.

A similar point of view seems to be implied in a prevailing idea of "character" standards; one which has been visualized by many individuals connected with the commercial marketing and manufacturing of cotton. There seems to be an idea prevalent that cotton character might be represented in some simple fashion by a few properly chosen samples. The difficulties are evident, however, when we realize the number of fibre properties, as discussed by Conrad and Webb,[1] which may affect some yarn property: say, yarn strength. If we assume, for example, that only four fibre properties are concerned in the establishment of the character of the sample (and there may be more) and if we allow only three degrees of variation of each, we shall require at least 81 individual samples of cotton to represent all the possible variations. If we increase the variation of each property to five degrees, we shall require 625 standards adequately to represent character.

The mere establishment of cotton standards in theory does not, however, solve the problem or help the situation very much. That is, unless and until more practical ways and means can be provided for adequately comparing the character of an unknown sample against such standards, or for applying the standards to the crop, the desired effectiveness of character standards cannot be obtained. The Bureau's fibre and spinning tech-

nologists are, however, working on these complicated problems, and progress is being made.

Dr. Huber has commented on the importance of sampling and the problems connected with it. We recognize this as one of the most important problems that we have in the measurement of the physical properties of cotton fibres. A bale of cotton contains somewhere in the neighborhood of 50 billion fibres, and, from microscopic observations, it seems highly probable that no two of them will be exactly alike. A single length array comprises about 75 milligrams of fibres. When such an array is used to represent a bale of cotton it must represent nearly 29 million times its own weight. When 9 arrays are averaged, the result must still represent over 3 million times its weight. Consequently, we have had to take great precautions in sampling. Furthermore, we have been investigating methods of mixing, and the possibilities of chemical technics in some cases, to give homogeneous samples and thus reduce the sampling errors, as discussed before a meeting of our Raw Cotton Sub-Committee sometime ago by our Dr. Conrad.[2]

Dr. Huber has referred to moisture equilibrium problems in connection with the various textile fibres, including cotton. We have been forced to recognize these for some time in connection with our cotton quality researches and testing. The extensive work of Hartshorne,[3] Urquhart[4] and his associates, Masson and Richards,[5] and Fuwa and Godbout,[6] have been familiar to us. In 1936 we introduced the procedure in our own testing laboratories of double air conditioning; *i.e.*, conditioning all samples to be tested, first at 40 per cent humidity, followed by 65 per cent, or "standard" humidity. In this way we sought to reduce the variability of results arising from this cause. We have discussed and advocated, before Sub-Committee B–1 on Humidity, the adoption of more stringent specifications for air conditioning technic with the idea of reducing fluctuations resulting from the so-called "hysteresis effect."

We have noted with satisfaction the recent revival of interest in moisture problems as attested by the work of Walker,[7] Davidson and Shorter,[8] Filby and Maass,[9] Hamm and Patrick,[10] and, more recently, F. Walker, Campbell and Maass.[11] Although no unity of opinion has yet been noted on the cause of the peculiar behavior of cellulose and other organic substances in the attainment of moisture equilibrium, the revival of interest should hasten the solution of this important problem.

In connection with Dr. Huber's reference to fineness, strength, and maturity of cotton fibre as now detailed in A. S. T. M. Designation D–414–35T, I may say that the measurement of these properties has been described more fully in a recent publication from our laboratories by Richardson, Bailey and Conrad.[12] (Copies may be obtained upon request.)

In connection with cotton fibre fineness, I may mention in passing that we are investigating the possibilities of using geometrical or cross-sectional areas and shapes. Considerable progress along this line has recently been made by those working with wool fibres. The very great variability in the cross-sectional shapes and areas of cotton fibres, however, gives us a more difficult problem than that of wool.

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Discussion by Malcolm E. Campbell *

A TEXTILE MANUFACTURER, or a purchaser of textile materials, tests his product in order to get in a short time as complete and as accurate a picture as possible of the suitability of the product, either for further processing or for the service for which the completed product is intended. If it were not for the consideration of time and expense his best test would be that of actual performance under service conditions. This, however, is seldom possible, and it behooves him to select that test which will give him the information which most nearly fits his requirements. Accordingly, no one test can ever be expected to serve all purposes.

Further, various kinds of tests are required to meet different purposes. For example, the manufacturer of thread is not interested in the bursting strength of a fabric which might be woven from that thread; neither is the manufacturer of absorbent cotton particularly concerned with the tensile strength of yarn that might be spun from his product. And so it goes. That type of test must be selected which will give most nearly an index of quality for the particular service for which the product is in-

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tended. No single test for yarn can be expected to provide adequate information for all who make or use yarn.

There seems to be a growing belief that the skein test for yarn is unsound and unscientific, and that the sole excuses for its existence are tradition and the fact that it is easy to perform. It is also a general belief that sometime, somewhere, there will be developed a single-strand tester that will answer any and all requirements for all time. Unquestionably such a machine would find a ready market in the mills and laboratories of the world.

It is not intended in these brief comments to attempt to vindicate the skein test, nor to denounce the single-thread test. Without doubt both have their proper places in textile research and testing. However, it is time, I believe, for someone to point out a few facts in regard to the skein test that are frequently overlooked.

There would appear to be some significance in the fact that in most of the outstanding foreign laboratories conducting cotton quality investigations, more emphasis is placed on the skein strength as a criterion of cotton quality than on any other one factor. The Rock Bank Laboratories, of Bollington, England; Shirley Institute, near Manchester; the Indian Central Cotton Committee's laboratories in Bombay; and that of the Ministry of Agriculture in Giza, Egypt; in all of these institutions the skein test is used continually and primary consideration is given to the results.

Dr. W. Lawrence Balls, well-known British cotton investigator, in his book entitled "Studies of Quality in Cotton" gives considerable space to an analysis of the skein test. The following comments are quoted from the chapter in which this work is discussed: "The strength of yarn is indicated by a figure obtained in the lea (skein) test; this figure is known to be dependable, and to have a practical usefulness; moreover, as will be seen presently, this figure has a sufficiently definite scientific meaning." He adds that "The rapidity with which (the lea test) is made and the consistency of its results confer advantages upon which it is hard to improve. . . . My general conclusion is that the lea test is a radical one, in spite of its composite nature, and that in so far as it deviates from indicating the strength of the weakest link, so those indications approximate more closely to the value of the yarn in fabric form."

In the spinning laboratories of the Bureau of Agricultural Economics it has been found that the test is precise and repeatable, and very sensitive to changes in the quality of cotton and to the effects of variables of machines and technic. Means are provided for determining the count of each test specimen, and allowances can be made for variations in the count. A skilled laboratory technician can, with suitable equipment, test conditioned skeins at the rate of about 50 per hour, determining and recording both the breaking load and the count of each specimen. It is imperative that attention be given to the smallest detail when establishing routine procedure for skein testing. This was brought home to us very clearly recently, in tests made to equalize the results on duplicate specimens in our laboratory in South Carolina and our newly-established laboratory in Texas. With proper consideration to each step in making skein tests, however, it is entirely feasible to standardize the technic and remove all variables except that of the yarn being tested.

One of the chief shortcomings of the skein test, as pointed out by Dr. Schiefer, is that it does not indicate the uniformity of the yarn; that is,

the variation in strength of short lengths of yarn. Where this information is of prime importance, the single thread test must be used.

In addition to the two types of single-thread testers described by Dr. Schiefer, there is being used with considerable success in the laboratories of the Bureau of Agricultural Economics an automatic tester of English manufacture which tests six threads simultaneously, recording the successive breaking loads of each as perforations in a chart. The automatic and multiple-strand features of this device make it many times faster to use than the other types with which we are familiar. This fact is important in view of the variability of single-thread test data and the consequent large number of observations required to provide a reasonably precise average. An objection to the machine has been the difficulty of analyzing the charts with any degree of precision. To overcome this obstacle there has recently been developed in the laboratories of the Bureau a quick and accurate method of analyzing the charts graphically, so that the mean and standard deviation of the 480 individual observations on a chart can be secured in a very few minutes.

In view of the influence of yarn count upon the breaking strength of yarn, there would seem to be a need for some means of measuring and recording the count of the short lengths of yarn as they are tested for strength on a single-strand tester. Under present conditions, when testing for comparative purposes, it is difficult to determine what part of the difference in strength of two yarns should be attributed to the differences in the count of the specimens tested.

Abstracts

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Address, C. H. Clark, Sec., 65 Franklin St., Boston, Mass.

I. Fibres (Synthetic and Natural) and Fibre Analysis

Amino Nitrogen in Insoluble Proteins: Estimation of. H. A. Rutherford, Milton Harris and Arthur L. Smith. *Am. Dye. Rptr.*, Nov. 1, 1937, P. 650–55.

An apparatus is described for determining the rate of evolution of nitrogen from proteins and other amino compounds during treatment with nitrous acid. Examination of the rate curves of a number of proteins indicates that there is a primary reaction with a relatively rapid evolution of nitrogen followed by a secondary reaction with a much slower evolution of nitrogen in which the rate is approximately constant. Extrapolation of the straight line portions of the curves in zero time gives values which appear to be good estimates of the amino nitrogen contents of the proteins. (C)

Artificial "Animal" Fibres. B. G. Ferris. *Tex. Col.*, Nov. 1937, P. 750–51. (C)

Casein: A Technical Summary. Chemitex. *Tex. Col.*, Nov. 1937, P. 754. (C)

Cotton: What Kind Does the Spinner Want? F. T. Pierce. *Tex. Mfr.*, Nov. 1937, P. 435, 440.

An explanation of what the cotton spinners might ask of the growers in so far as they yet know the technical "character" required in the cottons. (C)

EUROPEAN STAPLE FIBRES: NEW AND INTERESTING. P. A. Koch. *Rayon Tex. Mo.*, Nov. 1937, P. 53–6.

A very complete list and description of existing foreign rayon staples, illustrated with cross-sectional and longitudinal microphotographs. (C)

FIBROIN FIBRE: EFFECTS OF THE ORIENTATION OF MICELLES ON THE VARIOUS PROPERTIES OF. I. MECHANICAL PROPERTIES. II. SORPTION AND ALLIED PHENOMENA. C. Matana and T. Ozawa. *J. Soc. Chem. Ind. Japan.* 40 Suppl. binding, 1937, P. 174–79; abs. in *C. A.*, 1937, V. 31, Col. 6468. (W)

ISOELECTRIC POINT OF THE FIBROIN OF CHINESE SILK. Chen Wang and Tsong-Tsai Woo. *J. Chinese Chem. Soc.*, 1937, V. 5, P. 170–3; abs. in *C. A.*, 1937, V. 31, Col. 6468.

Fibroin sols are prepd. by the method of Harris and Johnson (*C. A.*, V. 24, P. 3375). The isoelec. points detd. by the colorimetric method are: mulberry silk, 2.4—2.6 and tussah silk, 4.2—4.4. (W)

FLEECE AND SKIN WOOLS. Eber Midgley. *Canadian Tex. J.*, Sept. 17, 1937, P. 38–40.

A comparison of characteristics and manufacturing and dyeing properties based upon investigations conducted in the Textile Department of the Bradford (Eng.) Technical College to ascertain definite information concerning the behavior of skin wools during the process of manufacture. (C)

PROTECTING WOOL AGAINST INJURY BY MOTHS AND BEETLES BY MEANS OF EULAN PREPARATIONS. Albrecht Hase. *Mell. Textilber.*, 1937, No. 11, P. 901. (C)

RAMIE FIBRE. I. CULTURE AND PREPARATION. II, III. DEGUMMING, DRESSING AND PREPARING. J. Barbour Pears. *Tex. Mfr.*, 1937, Aug., P. 303–4, 308, 328; Oct., P. 410–11; Nov., P. 460–61.

Ramie is a desirable and useful material which has been held back by lack of development in fibre production from the plant. Processing by the waste silk spinning processes is described. (C)

RAYON: STRENGTH AND RELATED PROPERTIES OF—IN AQUEOUS SOLUTIONS. Shin-itiro Iwasaki and Toshiaki Miyamoto. *J. Soc. Chem. Ind. Japan*, 40, Suppl. binding, 1937, P. 163–4; abs. in *C. A.*, 1937, V. 31, Col. 6469.

The wet tensile strength, wet strength uniformity, wet elasticity and the elasticity uniformity of rayon threads were detd. in pure water, 0.1–1.0% soap soln., 0.5–3.0% NaOH soln., 1.0–6.0% Na_2CO_3 soln. and in buffered solns. of 7.8–10.00 pH after dipping for periods of 1–60 min. These properties were in every case characteristically dependent on the duration of dipping. The strength decreases sharply at first (1–3 min.), then increases to a max. (3–10 min.) and finally again decreases slowly. In the soap soln. the rayon gave lower wet strength but higher strength-uniformity, elasticity, and elasticity-uniformity than in pure water. There is thus less chance for damage of the yarn. In alk. solns. the wet strength sharply decreases with increase in concn. (C)

II. Yarns and Fabrics

Dry Finishing Rayon-woolen Blends. David Welsh. *Tex. Wld.*, Aug. 1937, P. 80.

Describes a new method which is claimed to give superior results. (C)

Drying: Prolonged vs. Rapid. Heinz Haas. *Mell. Textilber.*, 1937, No. 11, P. 912.

The researches carried out by the author have revealed beyond any possibility of doubt that fibrous material may be as seriously injured by prolonging the time of drying overmuch, even at a medium temperature, as by a rapid drying process at too high a temperature. Further conclusions are thereby permitted about the purely organic reactions that may take place in the fibre, depending upon the period of time involved. It is accordingly necessary, when working out drying processes for textile materials first to clear up the physical and chemical properties of the various types of fibre. The drying process developed on the basis of that knowledge should provide for as short a drying period as is compatible with economic working and those temperature limits must be maintained which are indicated by the necessity of drying the material thoroughly satisfactorily. (C)

Elasticity in the Finishing of Textiles: Significance of the. Kurt Quehl. *Klepzig's Textil-Z.*, 1937, V. 40, P. 410; abs. in *C. A.*, 1937, V. 31, Col. 6468.

The elasticity of textile fabrics can be improved by the use of the Tootal process of the Tootal Broadhurst Lee Co. of Manchester or the Preska process of the Chemische Fabrik Theod. Rotta of Zwickau in Saxonia. The treatments and the results are discussed. (W)

Fancy Yarns in Novelty Fabrics. Eber Midgley. *Tex. Recdr.*, Oct. 6, 1937, P. 23–4.

Describes new combinations of materials and yarn structures. (C)

Fiberglas for Textiles: An Insight into a New Product. J. L. Tucker. *Cotton*, Nov. 1937, P. 41–43, 102; *Am. Wool & Cotton Rptr.*, Oct. 14, 1937, P. 29–30, 58.

Describes characteristics and properties of "Fiberglas," as developed by Owens-Illinois Glass Co., and its present and probable future uses as a textile fibre. (C)

Finish of Broadcloths: Factors Influencing. Robert A. C. Scott. *Rayon Tex. Mo.*, 1937, Oct., P. 61–3, 78; Nov., P. 66–8. (C)

Finishing Modern Spun Rayon Fabrics. B. S. Hillman. *Rayon Tex. Mo.*, 1937, July, P. 60–2; Aug., P. 55–7; Nov., P. 57–9, 63. (C)

Frosted Wool for Scoured Wool. L. Stearns Gay. *Am. Wool & Cotton Rptr.*, Oct. 21, 1937, P. 9–10, 43–4.

Advantages in spinning, weaving and finishing of flannel topcoating. Dyeing possibilities tested on polo cloth. Findings and conclusions on 12 items. (C)

GRIMM METHOD OF WEAVING FOR COVER AND CLOSE-SET WEFT. *Tex. Mfr.*, Sept. 1937, P. 368.

By separate tension control, changed at beat-up, well-covered, heavily-picked, or uniform and strong rayon and cotton cloths can be woven. (C)

HIGH DRAFTING. Horace Spibey. *Tex. Recdr.*, Oct. 6, 1937, P. 39.

The article indicates and the author states: "It is not unlikely that within the next few years those operations in cotton spinning which, up to the present time have been recognized as fundamental will have given way to others in this march of progress." (C)

MODERN (COTTON) SPINNING TECHNIQUE. W. Frank Lowell. *Am. Wool & Cotton Rptr.*, Oct. 14, 1937, P. 23–4, 52–7.

Noting that "the art of cotton spinning has advanced more in the last ten years than in the previous half a century," the author describes the nature of this advance, and the resulting improved quality of product, lowered costs, and longer machine life. Research, both basic and applied, has been largely responsible for the progress made. From address at convention of National Association of Cotton Manufacturers, Providence, R. I., Oct. 1937. (C)

PHYSICAL PROPERTIES OF KNITTED FABRICS. Wm. Davis. *Tex. Recdr.*, Oct. 6, 1937, P. 26, 29.

Synopsis of a lecture by the author describing present trends and modern methods of analysis. (C)

RAYON CRÊPE RESEARCH: REPORT OF THE. W. F. Macia. *Am. Dye. Rptr.*, Nov. 1, 1937, P. 670–1.

This is the first part of the report on this research, which was a joint project of the A. A. T. C. C. and the Throwsters Institute. The results as published have the approval of the Joint Committee under whom the work was conducted by W. F. Macia as Research Associate. This part contains (1) the results of a survey made in numerous throwing and weaving plants to determine the limitations and extent of variations in each mechanical process in the commercial manufacture of 200 denier rayon crêpe yarns and to determine average methods to use in subsequent work; (2) a supplementary survey of plants operating on 75, 100 and 150 denier rayon crêpe yarns; and (3) an investigation which included a comparison of the winding qualities of rayon skeins in a rayon producing plant and a throwing plant. (C)

SHRINKAGE TABLES. John A. Stewart. *Tex. Wld.*, Oct. 1937, P. 101–108.

For quick determination of one-half to 25% shrinkage covering pieces ranging from 50 to 100 yards; reprints may be obtained from the publishers at 25c per copy. (C)

SLASHER ROOM MANAGEMENT. A. K. Landau. *Canadian Tex. J.*, Sept. 17, 1937, P. 33–4.

Suggestions as to producing of properly sized warps of satisfactory appearance and maximum weaving qualities. (C)

SPINNING STAPLE FIBRE IN THE COTTON SPINNING MILL. F. Kaiser. *Mell. Textilber.*, 1937, P. 411; abs. in *Rayon Tex. Mo.*, Oct. 1937, P. 103.

A general review of which the following is of special interest: Staple fibre absorbs moisture more rapidly than cotton, but also parts with it more quickly. The cotton spinning shed should have a relative atmospheric humidity of from 60 to 65%. Adhesion of the fibres to the rollers of the drafting frame when the temperature of the shed is too low causes more trouble than when spinning cotton, but if the temperature is allowed to rise above 20° C. (68° F.) staple fibre is liable to become charged with static electricity. (C)

SPUN RAYON: DEVELOPMENTS IN. F. Bonnet. *Am. Dye. Rptr.*, Nov. 29, 1937, P. 724–25. (C)

SPUN RAYON: FUTURE OF. Alexis Sommaripa. *Rayon Tex. Mo.*, Nov. 1937, P. 33–5; *Am. Wool & Cotton Rptr.*, Oct. 14, 1937, P. 25–8, 40.

Paper delivered at annual convention of National Association of Cotton Manufacturers, Providence, R. I., Oct. 6, 1937, describing the present field occupied by spun rayons and their probable future. Mixtures with natural fibres and with new syntheties will broaden the present field. (C)

STRENGTH OF COTTON, STAPLE FIBRE, AND MIXTURE YARNS, AND UTILIZATION OF THEIR PROPERTIES. Part II. O. Schmidhäuser. *Mell. Textilber.*, 1937, No. 11, P. 856. (C)

TEMPERATURE CONTROLS ON SLASHERS: BETTER WEAVING CONDITIONS SECURED BY. Francis A. Westbrook. *Cotton*, Aug. 1937, P. 67–9. (C)

TESTING THE QUALITY OF SEWING COTTON. Dr. Friedrich Kurtz. *Mell. Textilber.*, 1937, No. 7, P. 494; No. 9, P. 690.

The first part of these investigations dealt with the changes involved in the doubling properties of 2/60's, 3/60's, and 2—3/60's folded yarns by sewing, and, as far as possible, sought for and determined the cause of these changes. In the present second part, the sewing properties of folded yarns that have been finished without a bleach are compared with those of similar yarns that have been bleached and then finished. (C)

THREAD TENSION IN THE DOUBLING OF WOOL AND THE LOSSES INVOLVED. C. L. Sustmann. *Mell. Textilber.*, 1937, No. 8, P. 559.

It was found that the twist apparatus for yarns spun with a right-hand twist and doubled with a left-hand twist, or vice versa, does not furnish reliable results upon the loss of length involved in doubling, because that loss is not related in any way to the stretch tension in the twist apparatus. Reeling should accordingly be used for determining the loss caused by twisting and doubling. (C)

III. Chemical and Other Processing (Not Otherwise Classified)

Dyeing Wool with Acid Dyes: Theory of. Dr. Ender and Dr. A. Müller. Part II. Property of Binding Dye Acid Depends upon the pH Value of the Dyebath. *Mell. Textilber.*, 1937, No. 9, P. 732.

Research has shown that the pH limit values of dyestuffs which, as coloristic examination shows, still plainly exhibit differences in their wet fastness often lie so closely together that the differences are often hardly greater than the limits of error of the methods of investigation applied. The differences also in the pH limit values are plainly shown only in the case of dyestuffs whose wet fastness lies wide apart. The assumption that dye acids with the greatest fastness to water would yield the highest pH values was confirmed. The property of binding acids falls off more strongly when the pH values are higher than the pH limit values of the corresponding dye acids. Wool ought not to absorb any more acid beyond its isoelectric point, which lies at pH = 4.9, but the determination of the pH limit values of a number of dye acids shows that the laws governing the reaction of wool with acids apply completely only when the combination of wool and acid can be easily hydrolyzed or reversed, as is the case, for example, with the combination of protein and hydrochloric acid. On the other hand, when compounds of wool and dye acid are difficult to hydrolyze, wool ought to absorb dye acids with the formation of salts even at pH values that lie above its isoelectric point.

Part III. Behavior of Acid Wool Dyes when Dyed in the pH Range above the Isoelectric Point of Wool. *Ibid.*, 1937, No. 10, P. 809.

It is evident from the results of the investigations described in this and the two preceding communications that there is a formation of salts when ordinary wool dyestuffs are fixed on the fibre in a dyebath with a hydrogen ion concentration ranging from strongly acid to weakly alkaline. Owing to the low hydrolyzing property of the wool and dye acid compounds, the equilibrium between wool, dye acid, and wool and dye acid compound is displaced to such an extent in favor of the wool and dye acid compound that the chemical combination of the dyestuffs with the wool takes place even at pH values which lie considerably above the isoelectric point of wool. The firmer, *i.e.*, the more irreversible, the combination of the dye acid anions with wool (which means great fastness to moisture), the higher are the pH values up to which chemical combination of the dye acid with the wool takes place and the better are such dye acids adapted for dyeing wool from a neutral bath. Owing to its amphoteric character, wool absorbs also cations from the bath above its isoelectric point. The number of dye acid anions combined rises with the pH values. There must therefore be a definite pH value for every dyestuff at which dye acid anions and cations are combined in equivalent proportion, so that the pH value of the dyebath undergoes no change during the dyeing process. That point can only coincide with the isoelectric point of the wool when the compounds of the protein both with the cations as well as with the anions are ideally reversible. (C)

CATALYSIS IN TEXTILE CHEMISTRY: ROSE OF. H. J. Henk. *Mell. Textilber.*, 1937, No. 10, P. 815.

Owing to the general impossibility of regulating them, catalytic processes are of greater interest than homogeneous catalysis, such as takes place, for example, in the action of acids upon hypochlorite solutions, which can easily be regulated by increasing the alkalinity. Catalyst and substrate form a homogeneous system in homogeneous catalysis, so that the whole mass of the catalyst takes part in the reaction, and the acceleration of the reaction that it produces is thus directly proportional to the number of molecules that it possesses. There are specific activators for every catalyst which lead to a further rise in the speed of reaction. All catalytic processes can be activated by raising the temperature, but the devitalizing process of the catalyst is thereby simultaneously initiated, so that the two components finally cancel out. Catalysts can also be activated by rays of light. The initiation of chemical reactions by rays of light does not itself fall under the conception of catalysis, but cases are known where catalysts are produced by irradiation of some kind or other. The catalytic acceleration of the effect of light rays upon cellulose fibres exerted by certain vat dyes may also be mentioned in this connection. (C)

HYDROGEN PEROXIDE STABILIZERS IN THE BLEACHING OF WOOL. R. Folgner. *Mell. Textilber.*, 1937, No. 8, P. 619.

The stabilizer Igepon T becomes useless after a short time owing to the action of the hydrogen peroxide, so that old bleaching baths must be replenished with fresh quantities at intervals, depending upon the time, temperature, and the concentration of the hydrogen peroxide. The addition of hardness forming salts to a hydrogen peroxide liquor containing Igepon T or an alcohol sulphonate generally results in lowering the stabilizing effect. The order in which the materials are added has an influence upon the extent to which the bleaching baths are decomposed. Calcium salts are generally less effective than magnesium salts, and sulphates are better than chlorides (with the exception of calcium chloride). (C)

MODERN VIEWS UPON THE WASHING OF TEXTILES AND THE CONSTITUTION OF MODERN DETERGENTS. ACTIVITY OF ANIONS AND CATIONS OF SOAPLIKE COLLOID ELECTROLYTES. Part I. A. Chwala and A. Martina. *Mell. Textilber.*, 1937, No. 9, P. 725–8.

The article first summarizes the labors of McBain, Lottermoser, Howell, Robinson, Hartley, Murray, and others which form the experimental basis for the active ionogenic condition of soaplike colloid electrolytes. The authors distinguish four main phases, as follows: (1) Complete breakdown of the anion and cation soaps into individual ions of large size capable of forming aggregates and counter-ions of small dimensions; the ionogenic state is completely active. (2) Aggregation of the soap ions to form pre-micellae, when the spaces between them are smaller than the rotation volume of the main valence chain. Mechanical and interionic (electrostatic) bonding of the counterions takes place simultaneously. (3) Further aggregation to form ionic micellae of a higher and more stable order than the pre-micellae, which are only loosely connected. (4) Charged particles of the anion and cation soaps owing to dissociation of soap constituents, for example, colloid ions. Undissociated molecular aggregates of

soaplike colloid electrolytes. The four stages of the active ionogenic state are connected with one another by equilibria; efforts were made to find a general formula. They may appear both as ionogenic disperse as well as molecularly disperse phases.

STABILITY OF SODIUM PERBORATE SOLUTIONS AND THEIR USE FOR THE BLEACHING OF COTTON FABRICS. Arthur J. Jinkings and Leo McGraghan. *J. Soc. Chem. Ind.*, 1937, V. 56, P. 238–44T; *Tex. Col.*, Nov. 1937, P. 745–9, 780.

A lab. investigation was made to det. some of the factors which govern the use of Na perborate as a bleaching agent for laundry work. Aq. solns. of Na perborate are stable in acid, but unstable in alk. soln. The addn. of soap has a very marked stabilizing effect on alk. solns., but the pH is an important factor. The selection of the best conditions of perborate concn. and temp. for good bleaching accompanied by no undue deterioration of the material is a matter for careful consideration. The process is best carried out in a wash liquor at temps. of from 60 to 100°, when full advantage can be taken of the beneficial action of the soap present. The higher the temp. that is used, the lower should be the concn. of the perborate. Under no circumstances should the bleaching of cotton fabric be carried out in a liquor free or almost free from soap. (C)

STOCK DYEING OF RAYON STAPLE. H. O. Kennette. *Rayon Tex. Mo.*, Sept. 1937, P. 92–3; *Cotton*, Sept. 1937, P. 74–5.

The author offers suggestions in stock dyeing of rayon staple fibre by the machines in use for cotton and wool. Contrary to general opinion it can be done successfully if a number of precautions are observed. (C)

STRESS-STRAIN CHARACTERISTICS OF WOOL AS RELATED TO ITS CHEMICAL CONSTITUTION. Arnold M. Sookne and Milton Harris. *Am. Dye. Rptr.*, Nov. 1, 1937, P. 659–66.

An apparatus for studying the extensibility of single wool fibres is described. Data on the effect of the tanning (quinone), dyeing, and deamination processes, and of neutral salts on the extensibility of the wool fibres are reported. The results indicate that the extensibility of the wool fibres is governed, for the most part, by factors which influence the swelling or hydration of the protein. Salt linkages of the type which might be formed by an attraction between the free amino and carboxyl groups in wool do not appreciably contribute to the physical stability of the fibre in aqueous solutions. (C)

SULFONATED (SULFATED) OILS: DETERMINATION OF UNSAPONIFIABLE NONVOLATILE MATTER IN. REPORT NO. 7 OF THE A. A. T. C. C. SUB-COMMITTEE ON SULFATED OILS. Ralph Hart, Chm. *Am. Dye. Rptr.*, Oct. 18, 1937, P. 634–38. (C)

TAUTOMERISM IN THE DYE CHEMISTRY. A. E. Porai-Koshitz. *Org. Chem. Ind.* (U. S. S. R.), 1937, V. 3, P. 71–6; cf. *C. A.*, V. 6, P. 1227; abs. in *C. A.*, 1937, V. 31, Col. 6884.

From a review of literature and some preliminary exptl. evidence, it is postulated that tautomerism is a common property of all classes of dyes

and is frequently characteristic of the dye intermediate products. The work in support of this theory is being continued. Ten references. (W)

TEMPERATURE CONTROL IN ACETATE DYEING: PROGRESS IN. E. H. Hammond and C. B. Ordway. *Rayon Tex. Mo.*, 1937, Sept., P. 92–6; Oct. P. 56–7.

Emphasizes the absolute necessity for dye temperature control in dyeing of acetate as well as acetate and viscose mixture fabrics in dyebecks. (C)

TEXTILE COLOR TERMS, SPECIFICATIONS AND PROBLEMS. Wm. D. Appel. *Am. Dye. Rptr.*, Nov. 1, 1937, P. 655–58.

The Committee on Color of the Research Committee of the A. A. T. C. C. undertook this survey at the request of the Inter-Society Color Council of which the Association is a member. Its purpose is to focus attention on the present color nomenclature and problems of the textile industry. It is hoped thereby to stimulate interest in these subjects and to promote a better understanding of them. If there is sufficient interest, it may be possible by concerted effort to develop a generally acceptable uniform system of describing colors and color differences and to solve some of the outstanding color problems. Similar surveys are being made in other organizations concerned with color in industry, in the arts, and in science. A comparison of the results obtained by these groups will be of general interest. (C)

TEXTILE DETERGENTS. H. Zimmerman. *Canadian Tex. J.*, Nov. 26, 1937, P. 39–41, 46.

Fundamental properties of the newer textile detergents and their applications to textile fibres and processes. (C)

TEXTILE PROCESSING IN GREAT BRITAIN DURING 1937. A. J. Hall. *Am. Dye. Rptr.*, Nov. 29, 1937, P. 781–83.

A review of advances made in bleaching, dyeing and finishing. (C)

UNSHRINKABLE WOOL FABRICS. *Canadian Tex. J.*, 1937, No. 12, P. 37; abs. in *Rayon Tex. Mo.*, Nov. 1937, P. 94.

The article gives the following method for making wool fabrics unshrinkable through chlorination: Concentrated hypochlorite liquor is diluted with water, so that the bath has a ratio of liquor-wool—20 and sufficient hydrochloric acid is added to acidify the liquor. After stirring well, the wool is added and worked as rapidly as possible for 20 minutes. It is then washed with cold water and finally rinsed with a solution of sodium sulphite or bisulphite, in order to destroy any trace of chlorine. If this process is followed by anti-chloring or peroxide bleaching the degree of unshrinkability is increased. (C)

VAT COLORS: POSSIBILITY OF CONTINUOUS DYEING OF—BY THE PIGMENT METHOD. Wm. F. Deady. *Am. Dye. Rptr.*, Nov. 15, 1937, P. 691–94. (C)

VAT DYESTUFFS: IDENTIFICATION OF—ON TEXTILE FIBRES. H. C. Borghetty and K. J. Broden. *Am. Dye. Rptr.*, Oct. 4, 1937, P. 589–99.

A translation, extension and adaptation of the original chart on Vat Color identification which appeared in the February–March issue of the *Bollettino dell' A. I. C. T. C.* of Milan, Italy. The writers give due credit to the author, Prof G. Buzzi-Ferraris, who established the procedure of the reactions and compiled the bulk of the chart. (C)

IV. RESEARCH METHODS AND APPARATUS

ABRASION AND WEAR TESTING. H. J. Ball. *Rayon Tex. Mo.*, Nov. 1937, P. 42–3.

Concluding portion of paper presented at Papers Session of Committee D–13 of the A. S. T. M., Oct. 21, 1937. The first part of the complete paper contains descriptions of the mechanical features of eleven abrasion or wear testing machines. The complete paper appears in the December, 1937, Bulletin of the A. S. T. M. (C)

ABRASIVES FOR WEAR TESTING. J. H. Lester. *Tex. Recdr.*, June 16, 1937, P. 37.

Abstract of a paper read at Textile Institute Conference, Southport, Eng., June 1937. (C)

CROSS-SECTIONS: NEW, RAPID METHOD FOR MAKING. Paul August Koch. *Rayon Tex. Mo.*, Oct. 1937, P. 75.

Describes the Viviani-Herzog cut-cork method. (C)

CRUSH RESISTANT FINISHING TREATMENTS FOR FABRICS: EVALUATION OF. H. F. Schiefer. *Am. Dye. Rptr.*, Nov. 1, 1937, P. 667–69.

Perhaps the most unsatisfactory tests in textile analysis are those for evaluating the "hand" or "feel" of a fabric. With the increasing interest in permanent and anti-crease finishes, the need of quantitative, scientific methods for measuring these finishes has become acute. Dr. Schiefer of the National Bureau of Standards in this paper offers a clean-cut, accurate, and scientific method for evaluating one of the physical factors, viz., The Crush Resistance of Pile Fabrics. (C)

DURABILITY OF CRIMP IN ARTIFICIAL FIBRES. O. Schmidhäuser. *Tex. Mfr.*, Nov. 1937, P. 462.

Artificial fibres are usually crimped, but compared with wool do not hold the crimp. A method of measuring crimp-retaining property is described. (C)

FIBRE STRUCTURE: EXPERIMENTS WITH MODELS OF SYNTHETIC BODIES OF HIGH MOLECULAR WEIGHT TO ELUCIDATE PROBLEMS OF. H. Staudinger, M. Staudinger and E. Sauter. *Mell. Textilber.*, 1937, No. 11, P. 849. (C)

FIBRES AND PRACTICAL ANALYSIS OF FIBRE MIXTURES: IDENTIFICATION OF. N. Cryer. *Tex. Mfr.*, Nov. 1937, P. 465–66, 471.

Describes and tabulates methods which have been tested in use. (C)

INSTRUMENTATION STUDIES. XX. STUDY OF PHOTOELECTRIC INSTRUMENTS FOR MEASUREMENT OF COLOR: REFLECTANCE AND TRANSMITTANCE. Staff of The Institute of Paper Chemistry. *Paper Trade J.*, 1937, Oct. 28, P. 135–41; Nov. 4, P. 27–39.

The purpose of the study was critically to investigate the existing photoelectric instruments in the laboratory, and to delimit, where possible, their fields of valid application in the pulp and paper industry. (C)

METALS: DETECTION OF—IN FIBROUS MATERIALS, DYES, AND ORGANIC PIGMENTS. Ellis Clayton. *J. Soc. Dyers Col.*, Oct. 1937, P. 380–89. (C)

NEOCARMIN FOR FIBRE IDENTIFICATION. *Tex. Col.*, Nov. 1937, P. 775 (reprinted from *Textile Mercury & Argus*). (C)

PLIABILITY OF RAYON YARN CAN NOW BE DETERMINED. *Rayon Tex. Mo.*, Sept. 1937, P. 113–14.

Describes U. S. Testing Co.'s new "Flexease" Tester and its use. (C)

STAPLE RAYON: DETERMINATION OF—IN MIXED GOODS BY MECHANICAL SEPARATION. K. Schulze and H. Springmann. *Monatsh. Seide Kunstseide*, 1937, V. 42, P. 52–5; *Mell. Textilber.*, 1937, V. 18, P. 486–8; abs. in *C. A.*, 1937, V. 31, Col. 6469. (W)

TESTING BY FLUORESCENCE. J. A. Radley. *J. Soc. Dyers Col.*, Oct. 1937, P. 376–79; *Tex. Mfr.*, Nov. 1937, P. 469.

Summarizes briefly the uses to which this method of testing may be put in the textile and associated industries. (C)

TESTING DYNAMIC CHARACTERISTICS OF INDIVIDUAL FILAMENTS. Irving J. Saxl. *Rayon Tex. Mo.*, Sept. 1937, P. 111–13.

The precision and sensitivity of the new Filament Tester described is such that the complete dynamic characteristics of single filaments or individual hairs can be determined with precision. (C)

TESTING RESEARCH LABORATORY: WEST POINT MFG. CO. OPENS NEW. John C. Fonville. *Cotton*, Sept. 1937, P. 57–62.

Illustrated description of the well-equipped and staffed testing laboratory recently completed by this cotton mill. (C)

TEXTILE NOMOGRAPHS. L. Shapiro and J. M. Durand. *Tex. Wld.*, Aug. 1937, P. 91–4.

The following nomographs are published, with directions for their use: Moisture content vs. moisture regain; conversion of degrees Centigrade to degrees Fahrenheit; correction of yarn strength to 7% regain; conversion of yards per pound to ounces per yard; conversion of specific gravity to degrees twaddle and degrees Baumé. (C)

TEXTILE TESTING AND TEXTILE MICROSCOPY: RECENT DEVELOPMENTS IN. John H. Skinkle. *Am. Dye. Rptr.*, Nov. 29, 1937, P. 786–87. (C)

TEXTILE TESTING: PHYSICAL AND CHEMICAL. John H. Shinkle. *Am. Dye. Rptr.*, 1937, Sept. 6, P. 527–36; Sept. 20, P. 563–67; Oct. 4, P. 599–602, 608–13; Oct. 18, P. 625–30; Nov. 15, P. 694–700.

Part 1 of a series of articles—(1) Physical Testing, (2) Chemical Testing, (3) Optical Testing—covering textile test methods and practice advised by the author for the use of manufacturers and consumers. The subjects covered in the first instalment are Statistical Analysis, Moisture Determination including regain. Additional chapters of the Physical Testing section are testing of fibres, of yarns, of fabrics, and strength and elongation of fibres, yarns and fabrics. The author is associated with the chemistry department of Lowell Textile Institute. A valuable feature of the articles is the bibliography relating to each test. (C)

VISCOSE AND CUPRAMMONIUM RAYON: HOW TO DISTINGUISH BETWEEN. A. Herzog and H. Ruckert. *Mell. Textilber.*, 1937, P. 485; abs. in *Rayon Tex. Mo.*, Nov. 1937, P. 93.

The iodine azide reaction was used to distinguish between viscose and cuprammonium rayon, but it was found that the reaction with cuprammonium rayon only appeared sporadically and even then was only weak. The authors advise extracting of the cuprammonium sample first with petroleum ether and laying it with a pair of forceps in the iodine azide solution. The reaction is best carried out in a watchglass under a magnifying glass or under a slightly magnifying microscope in a well ground out slide. (C)

WOOL: DETERMINATION OF ALKALI IN. D. E. Stocker. *J. Soc. Dyers Col.*, Sept. 1937, P. 348–49.

As the terephthalic acid method is not easy to manipulate, a new and more simple method has been studied, and is described, in which the alkali is extracted by an aqueous solution of boric acid, and the resulting sodium borate titrated with 0.1 *N* hydrochloric acid in presence of Methyl Red or Methyl Orange. This method has the advantages that (1) boric acid has no action on the indicators used and the adsorption of the acid by the wool does not affect the result; (2) sodium borate is easily removed from wool by washing with water; and (3) if the solution of boric acid be saturated with sodium chloride, calcium soaps and dyes are not extracted, so the difficulty of titrating a colored liquid does not arise. (C)

V. ECONOMICS, PHYSICS AND MISCELLANY

AGRICULTURE AS A POTENTIAL SOURCE OF RAW MATERIALS FOR INDUSTRY? Harold Hartley. *Tex. Recdr.*, June 16, 1937, P. 31–2.

The Mather Lecture delivered at annual meeting of the Textile Institute, England, June, 1937. (C)

CALCIUM DEPOSITS IN PROCESSING WATER: PREVENTION OF. B. H. Gilmore. *Rayon Tex. Mo.*, 1937, Aug., P. 69–70; Oct., P. 81–3. (C)

CELLULOSE: STRUCTURE OF. Harold DeW. Smith. *Rayon Tex. Mo.*, Oct. 1937, P. 39–43; *Tex. Rsch.*, Oct. 1937, P. 453–60.

Paper presented before Group C on Organic Materials at the Second Congress of the International Association for Testing Materials, London,

Eng., April 19, 1937. The author presents a brief but very complete summary of existing fundamental knowledge of the physical and chemical structure of cellulose, and in the accompanying discussion reviews and emphasizes the value of the new contributions of Dr. Wanda K. Farr and the new light that they shed upon certain disputed findings and theories. (C)

COLOR: RELATIONS BETWEEN THE CHROMOPHORE AND VALENCY THEORIES OF. M. Pestemer. *Angew. Chem.*, 1937, V. 50, P. 343–48; abs. in *J. Soc. Dyers Col.*, Aug. 1937, P. 333.

The new conception of the chromophore theory of color, based on the structure of the atom and the electronic theory of valency, regards the chromophore as any atom or atomic complex, the electrons of which, as a result of absorption of radiation, are converted into a higher state of energy. This conception is limited, however, for chromophoric purposes, to radiations of wave-length, 8,000–1,900Å. Conversion of the electrons into a higher state of energy is revealed by the appearance of bands of definite shape, intensity and position in the absorption spectrum. This new chromophore theory of color owes its importance to the fact that it supports, rather than disputes, the older chemical chromophore theory. However, both the changing valency number and the incomplete co-ordination number, as well as the incompletely saturated valency power, are attributed, equally for both organic and inorganic compounds, to the conception of the disturbed mobile gas configuration of the electron shells. In addition to the simple description of chemical facts, the true conception of the relation between light absorption and chemical constitution, necessitates knowledge of the quantitative results of investigations of the band spectra of the mols. in gaseous form, as well as current ideas of molecular structure afforded by the physical properties, *e.g.*, paramagnetism, dipole moment and molecular refraction. (C)

EXPOSED WATER SURFACES: SURFACE TENSION MEASUREMENT. N. K. Adam. *Proc. Roy. Soc.*, 1937, V. B122, P. 134–39; abs. in *J. T. I.*, July 1937, P. A405.

A rapid method is described for finding the surface tensions of natural water surfaces, based on observations of the behavior of drops of solutions of a spreading oil in a non-spreading oil. (C)

GELATINIZATION TEMPERATURE OF STARCHES: PHOTO-ELECTRIC METHOD. D. H. Cook and J. H. Axtmayer. *Ind. Eng. Chem., Anal. Ed.*, 1937, V. 9, P. 226–28; abs. in *J. Soc. Dyers Col.*, Aug. 1937, P. 332.

The temperature of the starch suspension is gradually raised and light passing through it falls on a photo-electric cell. The attainment of the gelatinization temperature is indicated by an increase in the photo-electric current. The shape of the graph of photo-electric current against temperature as abscissae is characteristic of the starch. Its slope, which seems to depend on the fragility of the starch granule, is very steep for most starches of tropical origin and much more gradual for most northern grain starches. Granule size seems to have little effect on rate of gelatinization. Gelatinizing agents, *e.g.*, acids, alkalis, sodium thiocyanate, and calcium chloride, raise the temperature at which the suspension shows its first increase in light transmission and, except with tropical starches, greatly accelerate gelatinization. (C)

OXYCELLULOSE: INTERACTION WITH NESSLER'S REAGENT. H. Ditz and F. Ulbrich. *J. pr. Chem.*, 1936, V. 147, P. 167–87 (through *Brit. Chem. Abs.*, 1937, B, P. 331); abs. in *J. T. I.*, July 1937, P. A403.

Previous work and applications of Nessler's reagent for the detection of oxycellulose formed during the bleaching of cotton fabrics are reviewed. Cotton containing oxycellulose, when spotted with Nessler's reagent, gives a yellow coloration which changes through orange and brown to grey, the rate and extent of the change being related to the extent of oxidation and the copper number. The yellow color is attributed to the formation of mercurous iodide by reduction, presumably by aldehyde groups. The subsequent colour changes result from the decomposition of mercurous iodide into mercury and mercuric iodide. The latter redissolves and the final grey color with strongly reducing oxycellulose is therefore due to mercury. (C)

PAPER DRYING: THEORY OF. E. and B. Cowan. *Paper Trade J.*, Sept. 9, 1937, P. 37–43.

The authors develop theoretical formulae for predicting the performance of paper-drying machines and compare the results obtained by using these formulae with representative machines now in use. The paper includes a discussion of (1) the problems met with in the paper-making industry and how these problems can be dealt with theoretically in an effort to predict the performance of drying machines and (2) fundamental equations which can be used in designing and perfecting new equipment. (C)

PHOTO-ELECTRIC SPECTROPHOTOMETERS: APPLICATION. G. Kortum. *Angew. Chemie*, 1937, V. 50, P. 193–204; abs. in *J. T. I.*, July 1937, P. A401.

A critical review of the application of photo-electric measurements in spectrophotometry. The main chapter headings are (1) subjective, photographic and photo-electric methods and their appropriate uses, (2) development of the principle of photo-electric methods, (3) fundamentals of the method (spectral purity of the light, absolute and relative extinction measurements, photo-electric cells and their important properties, measurable light intensity reductions, intensification of the photo-current), and (4) various methods of applying photo-electric measurements. An extensive list of references is given. (C)

STARCH (IN PAPER SIZING): WHAT MAY WE EXPECT OF? Cobb, Lowe, Pohl and Weiss. *Paper Trade J.*, Aug. 12, 1937, P. 33–6.

A method has been outlined for determining the value of starch of any viscosity imbedded in any (paper) sheet finish. Starch, similar in constitution to cellulose, acts like a highly hydrated cellulose. It is weaker than cellulose and increases sheet strength by increasing the shrinkage of fibre structure to give a higher sheet density; starch also exhibits adhesive power independent of sheet density. The strength imparted by starch reaches a maximum at a definite concentration in the sheet. The maximum occurs around 0.5% and should be determined by the user to get the optimum results. (C)

STARCH. NATURE OF SOME OF THE HYDROLYTIC PRODUCTS. A. R. Ling. *Chem. & Ind.*, 1937, V. 56, P. 346–48; abs. in *J. Soc. Dyers Col.*, Aug. 1937, P. 332. (C)